Acid mine drainage in an Indian high-sulphur coal mining area: cytotoxicity assay and remediation study

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Abstract

Opencast mining causes significant environmental concern due to acid mine drainage (AMD) caused by the oxidation of pyrites and other sulfur-bearing minerals. The present study intends to determine the seasonal variability of AMD in the affected area of the Ledo opencast mining, the cytotoxicity of the AMD, and the AMD remediation process. The physicochemical properties of the collected samples were analyzed by using laboratory-based methods and sophisticated instrumental tools. The cytotoxicity study of AMD water was performed by using different cell lines such as normal rat muscle and human carcinoma cells. The study demonstrates that the mine water samples show high conductivity (1.30-2.49 ms cm^{-1}) with high total dissolved solids (1068-1339 ppm) which can change the ionic composition of water. The concentration level of trace elements are also found to be higher than the permissible limit (EPA, 2002) during monsoon season. A simple laboratory-based remediation process of AMD has been carried out in the current study by using size segregated pulverized limestone and the process reveals the decrease in elemental concentrations of AMD water. This study will be useful to develop a remediation technique to minimize the concentration levels of hazardous elements and ions in the AMD water.

Keywords: AMD, High-sulfur coal, remediation of AMD, Seasonal variation, Cytotoxicity, statistical analysis